REMARKS

By this reply, claim 30 has been amended. Claims 20-30, 34-40 and 48-51 are pending in the application. Favorable consideration is respectfully requested.

Rejection Under 35 U.S.C. § 112, ¶1

Claim 49 was rejected under 35 U.S.C. § 112, ¶1, for allegedly failing to comply with the written description requirement. The rejection is respectfully traversed.

The Office asserts that the specification does not "specifically state" that the die compaction takes place without external lubrication. The Office further asserts that "there is no evidence presented that any specific advantage is gained by using no external lubrication." However, there is no legal requirement that the specification must provide a verbatim written description of the subject matter of a claim. *See* M.P.E.P. § 2106(V)(B)(1), page 2100-14. To comply with the written description requirement, "an applicant's specification must reasonably convey to those skilled in the art that the applicant was in possession of the claimed invention as of the date of the invention" (citation omitted). *Id.*

The specification describes the following three alternatives for performing the method: (1) combining iron or iron-based powder with an internal lubricant (page 4, last paragraph); (2) using external lubrication (page 5, first paragraph); or (3) using a combination of internal and external lubrication (paragraph 5, first paragraph). In other words, alternative (1) uses an internal lubricant without an external lubricant, alternative (2) uses an external lubricant without an internal lubricant, and alternative (3) uses both an internal lubricant and an external lubricant. Alternative (3) makes it

clear that neither one of alternatives (1) and (2) uses both types of lubricant. The Office has not explained why these three disclosed alternatives, when considered together, do not provide support for the subject matter of claim 49.

Moreover, there is no requirement to provide evidence that any specific advantage is gained by using no external lubrication in order to comply with the provisions of 35 U.S.C. 112, ¶1.

Applicants submit that the specification provides express disclosure showing that they were in possession of the claimed subject matter as of the date of the invention, and thus also supports the recitation in claim 49 that the compaction is performed without using external lubrication. Original claims 7-9 also provide support for these features. Thus, it is respectfully submitted that the specification provides a written description of the subject matter of claim 49 that complies with the provisions of 35 U.S.C. 112, ¶1. Therefore, withdrawal of the rejection is respectfully requested.

Rejection Under 35 U.S.C. § 112, ¶2

Claim 30 was rejected under 35 U.S.C. § 112, ¶2. The rejection is respectfully traversed.

As suggested by the Examiner, claim 30 has been amended to depend from claim 21 to provide antecedent basis for the features of claim 30.

Withdrawal of the rejection is respectfully requested.

Rejections Under 35 U.S.C. § 103

A. Claims 20-30, 34-38, 40, 48 and 49 were rejected under 35 U.S.C. § 103(a) over U.S. Patent No. 6,638,335 to Ozaki et al. ("Ozaki"). The rejection is respectfully traversed.

Claim 20 recites a process for preparing high density green compacts comprising (a) subjecting a composition of an iron or iron-based powder, wherein less than about 5% of the powder particles have a size below 45 μm, and a lubricant added to the powder in an amount between about 0.05% and about 0.6% by weight, to uniaxial compaction in a die at a compaction pressure of at least about 800 MPa; and (b) ejecting the green body from the die (emphasis added). In the claimed process, the lubricant is added to the powder in an amount between about 0.05 and about 0.6% by weight, less than about 5% of the powder particles have a size below 45 μm, and the compaction pressure is at least about 800 MPa.

When a powder is compacted to high density using a high compaction pressure, the ejection force needed to eject the compacted body from the die affects the surface finish of the compacted body. The higher the ejection force, the greater is the risk that a deteriorated compact surface will be obtained. The process recited in claim 20 resulted from the inventors' unexpected finding that coarse powders can be compacted to produce green bodies that have both high densities and shiny surfaces.

The specification describes comparative test results that demonstrate unexpected results that can be provided by embodiments of the claimed process. In Example 1 described at pages 6-7 of the specification, two different iron-based powder compositions according to the claimed process were compared with a standard iron-based powder composition. All three compositions were produced with Astaloy Mo. As shown in the attached information entitled "Höganäs Iron and Steel Powders for Sintered Components," Astoloy Mo has a typical particle sieve analysis of 0 +212 µm, 15% + 150 µm and 20% - 45 µm. Graphite and a lubricant were added to the compositions. For one of the powder compositions, particles of the Astaloy Mo with a diameter less than 45 microns were removed ("+45 micron powder"), and for another powder composition, particles of Astaloy Mo having a size of less than 212 microns were removed ("+212 micron powder"). Fig. 1-1 shows the relationship between green density (GD) and compaction pressure for the three powders. A clear density increase at all compaction pressures was obtained with the +212 micron powder.

Fig. 1-2 shows the relationship between the ejection force (F_e) and compaction pressure. As shown, the ejection force for the compacts produced with the +212 micron powder is considerably lower than the ejection force needed for compacts produced from the standard iron-based powder composition including about 20% of the particles sized less than 45 microns. Moreover, the ejection force decreases with increasing compaction pressure, which is opposite to the relationship for the standard composition. The ejection force needed for compacts produced from the +45 micron powder is also lower than that of the standard powder.

The compacts produced by compacting the standard powder at a pressure above 800 MPa also have deteriorated surfaces. In contrast, the compacts obtained when the +45 micron powder is compacted at a pressure above 800 MPa have a more desirable surface. The test results demonstrate that components without deteriorated surfaces can be obtained by reducing particles smaller than 45 microns.

Example 2 is described at page 7 of the specification. As shown in Figs. 2-1 and 2-2, respectively, higher green densities and lower ejection forces are obtained using the +45 micron powder than with the powder composition containing the standard powder. Also, components produced from the standard powder have deteriorated surfaces at all compaction pressures.

Ozaki discloses a group of green compacts A1 to A18 in Table 1 at columns 5-8. Those compacts were formed using the compaction conditions A, B and C shown in Table 2, at columns 7 and 8. It should be noted that Table 2 shows that the amount of lubricant (zinc stearate) added was 0.75 mass percent, which is outside of the range of claim 20. Problems with damaged or deteriorated surfaces are related to high ejection forces. Applicants submit that Ozaki will have problems with high ejection forces as shown in Figure 1-2 of the present application wherein the standard powder shown corresponds to powder B12 in Ozaki.

Applicants have determined that if the particle size fraction less than 45 μm is removed, a considerably lower ejection force is achieved as shown in Figure 1-2. Ozaki shows examples with a high fraction of particle size below 150 μm and consequently large amounts of particles sized below 45 μm. Ozaki is silent regarding ejection forces after compaction and does not suggest any recognition of the problems associated with these particles smaller than 45 μm.

For at least the foregoing reasons, the process of claim 20 is patentable. Claims 21-30, 34-38, 40, 48 and 49, which depend from claim 20, are also patentable for at least the same reasons as those for which claim 20 is patentable. Moreover, these dependent claims recite additional features that are not suggested by Ozaki.

For example, claim 49 recites that the compaction is performed without using external lubrication. In Example 2 at columns 15 to 17 of Ozaki, iron powders were compacted at a compaction pressure of 1,177 MPa using only external lubrication. Ozaki produced green compacts with the highest density using condition C with no internal lubrication. See Tables 1 and 3 at columns 11-12 of Ozaki. According to Ozaki's test results, external lubrication, without internal lubrication, in combination with a high compaction pressure (1177 MPa) are necessary to obtain high green densities. As such, Ozaki does not suggest the method of claim 20.

Therefore, withdrawal of the rejection is respectfully requested.

B. Claims 39, 50 and 51 were rejected under 35 U.S.C. § 103(a) over Ozaki in view of U.S. Patent No. 5,134,881 to Rutz et al. ("Rutz"). The rejection is respectfully traversed.

Claims 39, 50 and 51 depend from claim 20. Applicants submit that Rutz fails to cure the above-described deficiencies of Ozaki with respect to the process recited in claim 20. Rutz discloses a method of making a sintered metal component. As was discussed in the Amendment filed on April 10, 2006, Rutz discloses using powders containing more than 20% of particles smaller than 45 μm. In Rutz, the

compaction is performed at elevated temperatures and comparatively high compaction pressures are used. The Office has established no suggestion or motivation to use Rutz's powders at a compaction pressure of at least about 800 MPa. Rutz does not disclose the compacts have any particular surface finish.

Applicants submit that Rutz does not suggest modifying Ozaki's process to produce the claimed process, which uses a coarse iron or iron-based powder, an internal lubricant, and uniaxial compaction at a pressure of at least about 800 MPa. The claimed process unexpectedly can produce compacts that have a desirable surface finish. The applied references also fail to recognize these advantageous effects. Therefore, withdrawal of the rejection is respectfully requested.

Conclusion

For the foregoing reasons, allowance of the application is respectfully requested. Should there be any questions concerning this response, the Examiner is respectfully requested to contact the undersigned at the number given below.

Respectfully submitted,

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HÖGANÄS IRON AND STEEL POWDERS FOR SINTERED COMPONENTS

Höganäs

Höganäs Handbook for Iron and Steel Powders
is intended for customer use.

The data presented in the handbook has been obtained from test specimens, sintered under well-controlled conditions, in the Höganäs laboratory.
Note that data established for any particular production equipment or conditions may differ from those presented in this handbook.

Typical data, Astaloy Mo

Apparent density, g/cm³	Flow, sec/50g
3.1	25

With inhibitor admixed

Sieve analys, %

+212 µm	0
+150 µm	15
- 45 µm	20

Compressibility, g/cm³

Compacting pressure	Lubricated die	0.8% Zn-st	0.6% Kenolube P11
400 MPa (28.8 tsi)	6.61	6.68	6.70
600 MPa (43.2 tsi)	7.10	7.12	7.13
800 MPa (57.6 tsi)	7.37	7.28	7.31

Green strength, MPa (10^3 psi)

Compacting pressure	Lubricated die	0.8% Zn-st	0.6% Kenolube P11
400 MPa (28.8 tsi)	12 (1.7)	9 (1.3)	10 (1.5)
600 MPa (43.2 tsi	22 (3.2)	13 (1.9)	17 (2.5)
800 MPa (57.6 tsi)	30 (4.4)	15 (2.2)	19 (2.8)

Chemical analysis, %

Carbon	<0.01
O-tot	0.1
Molybdenum	1.50